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Teachers College Syllabi, No. 4 *Price 30 Cents*

Teachers College
Columbia University

A Syllabus of a Course

ON

Elementary Woodworking

BY

WILLIAM NOYES, M.A.

ASSISTANT PROFESSOR OF INDUSTRIAL ARTS, TEACHERS COLLEGE
COLUMBIA UNIVERSITY

Published by
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NEW YORK CITY

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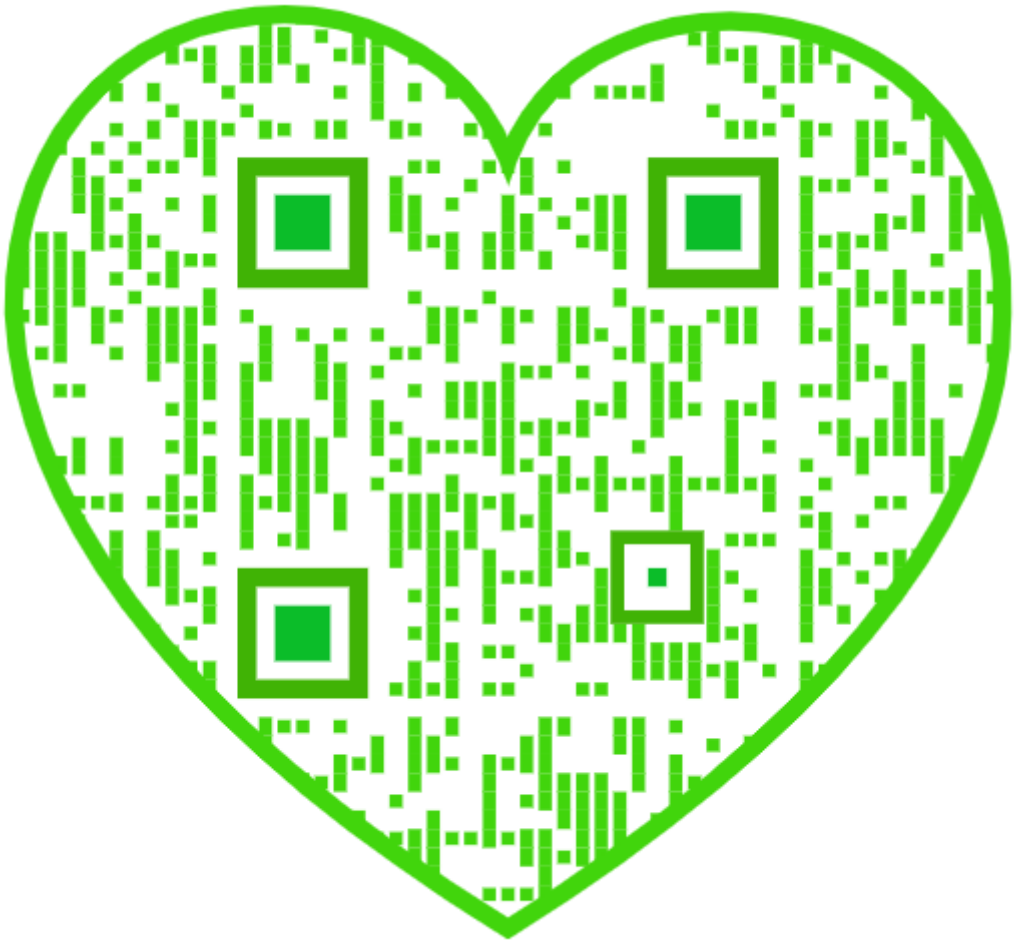

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ELEMENTARY WOODWORKING

INTRODUCTION

The course in Elementary Woodworking, as given at Teachers College, aims to give the student three main opportunities:

I. For the acquisition of skill in the handling of woodworking tools;

II. For practice in designing simple projects in wood;

III. For insight into the methods and problems of woodwork in the school ("Manual Training") shop.

I. In the following pages the outline of only the first of these objects is sketched: namely, a practicable method of procedure in the acquisition of skill. It will be noted that the course here outlined is so planned that:

1. A variety of woods is employed, each appropriate for its particular project. They are cypress, whitewood, maple, white pine, mahogany, chestnut, hickory, sweet gum, oak, and black walnut.

2. In general, the technical processes involved increase in difficulty through the series, but aesthetic considerations are not sacrificed to this formula.

3. Several types of construction are employed, involving such joints as end-lap, rubbed, miter, middle-cross-lap, doweled butt, mortise-and-tenon, and ledge.

4. A few simple processes in copper working are included because their employment considerably extends the range of useful and ornamental projects available.

5. A variety of finishes is suggested, including several methods of staining, as well as the use of such polishes as oil, wax, and shellac.

In a word, the course involves a considerable variety of experience in technical processes.

It is impossible, however, in these few pages to describe adequately fine points of technique. For some of these, references are made throughout the text to the author's books, "Hand Work in Wood" and "Studies in Wood, Design and Construction."[1] In the former book will also be found an extended bibliography of other books on woodworking. But let it not be

[1] The Manual Arts Press, Peoria, Illinois.

forgotten that however helpful books may be to the worker, they cannot fill the place of class or individual instruction and demonstration.

It should not be supposed that the projects here outlined constitute a hard and fast course, for new ones are frequently introduced. Those described are offered as typical.

In addition to the projects themselves, note books and drawings are required, as records of work accomplished. By a system of interchange of blue prints and photographs the designs of each student are available for all of the class.

In the chapters following, other projects involving the same or similar processes are suggested and illustrations and notes on these may be found in "Studies in Wood."

II. In the course as given at Teachers College, all but two of the projects, the picture frame clamp and the mallet, are such as to invite the worker to create his own designs. But in this pamphlet no attempt is made to discuss varied designs of the same project. A few general suggestions, however, may be offered for help in designing.

Artistic judgment and skill of hand develop best when they develop together. Drawing furnishes an invaluable means of indicating and recording designs, and its constant use is recommended, not only as a means of expression, but as a record of achievement.

It is also an exceedingly valuable practice to form a collection of photographs of good examples of simple projects, to which constant reference can be made. If these can be mounted on a uniform size of mount, 8½ x 11 inches, they may be conveniently kept in a vertical letter file.

The projects here given belong in the field of the space arts in which there are certain well recognized principles. These are well analyzed and illustrated in the following books: "Composition," by Arthur W. Dow; "A Theory of Pure Design," by Denman W. Ross; "Design in Theory and Practice," by Ernest A. Batchelder. To this matter of design considerable attention is given in the author's "Studies in Wood, Design and Construction."

It is of course impossible to reduce the subtle process of designing to a formula, but there are several important steps through which it may safely be said that the design of every project should go.

1. The *fixing of the essentials* or those features which make for an article's convenience in use. Under this head such matters as the following are determined:
   a. The approximate or definite size.
   b. The kind of wood to be used.
   c. The construction, including:
      (1) Kind of joint or joints;
      (2) Methods of opening and shutting or locking;
      (3) Appliances for lifting or moving or hanging.
2. *The refining of proportions:*
   a. of the mass as a whole;
   b. of each part to the whole;
   c. of each part to each other part;
   d. of each line within itself, if it curves or is a broken line, or is turned on a lathe.
3. *Decoration.* This relates to the treatment of the surface:
   a. Carving, border or surface (all-over) patterns in gouged lines or modeled.
   b. Panels, carved in or constructed in.
   c. Inlay or veneer.
   d. Designing of accessories, handles, knobs, keys, plates, escutcheons.
4. *Finish.*
   a. Stain.
   b. Paint.
   c. Oil.
   d. Wax.
   e. Shellac, including French polish.
   f. Varnish.

III. It is inevitable that the individual craftsman, working alone, should develop certain methods and practices which are not feasible with large classes. On the other hand, where a number of persons are to go through essentially the same processes, as in school shops, materials can often be more economically prepared, processes can be standardized, and operations facilitated by concerted action. This is true even when individual projects, not group projects, so called, are undertaken. In the elementary woodworking course at Teachers College these methods are provided for, but are necessarily omitted here.

I. SCRAP BASKET

In this project the prime object is to furnish an opportunity for considerable practice in sawing and planing, so that the beginner may master these elementary processes at once, and then to unite the pieces made in a useful, well-proportioned article.

Other projects that involve these fundamental processes of sawing and planing are such as can be made with a number of slats—for example, a leaf press, a table letter basket and a flower pot screen.

The making of only one type form is described here (Fig. 1), but in the author's "Studies in Wood," Chapter IV, there will be found suggestions for making original designs as well as detailed directions for executing them, and drawings and suggestions for other similar projects.

The pieces furnished to the student are to be cut to length and dressed both sides, so that narrow surface planing may precede the more difficult end and broad surface planing.

Materials and Measurements.

Cypress, spruce, or other soft wood:
- 2 pieces, 7/8" x 8" x 16".
- 1 piece, 7/8" x 8" x 8".

Wire brads, 7/8" No. 18.
7 doz. metalene upholstering nails, No. 220, brown or green.
1 can of penetrating oil stain, brown or green.
1 can of prepared wax.

Method of Procedure.

I. Making the 28 slats, each 3/16" x 7/8" x 16".

(1) Attend to the adjustments of the jack plane (see "Hand Work in Wood," pp. 69-71). (2) Mark one broad surface as the working face (see "Hand Work in Wood," p. 72). If the board is slightly warped, mark the concave side. (3) Plane straight and square both edges of both boards. (4) Gage, with marking gage, lines on both sides of both pieces 3/16" from both edges (see Fig. 2). (5) Reset marking gage, adding 1/4" and gage lines 7/16" from edges. (6) Reset marking gage at

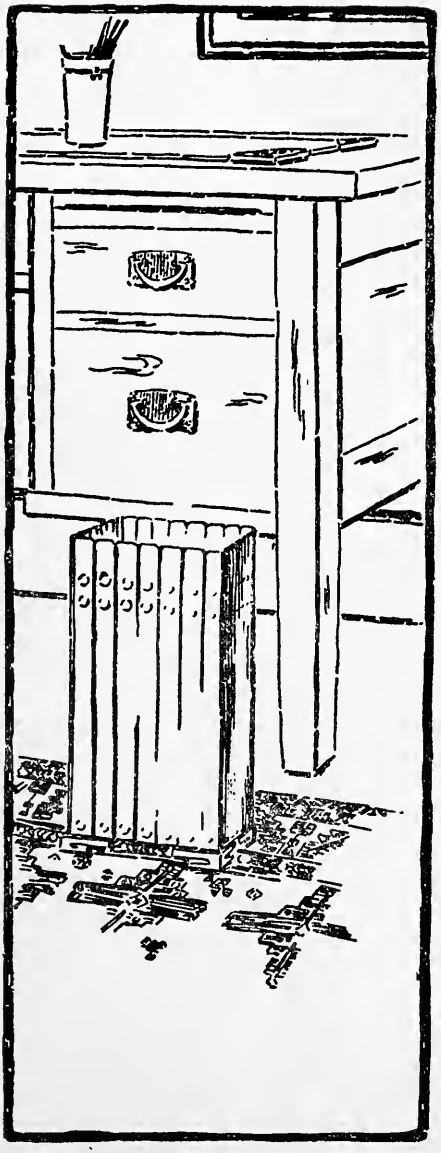

Fig. 1. Scrap basket.

10/16″ (⅝″), and gage again. (7) Continue to gage spaces alternately 3/16″ and ¼″ wide until 28 slats are laid out (see Fig. 2).

(8) Fasten one board in bench-vise, as in Fig. 89 in "Hand Work in Wood."

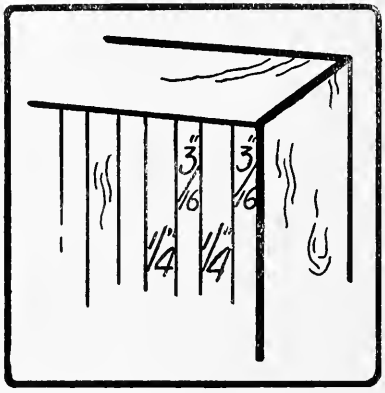

Fig. 2. Gaged lines on piece to be sawed into slats.

(9) Rip-saw one board through the center of the first ¼″ space ("Hand Work in Wood," p. 63). Saw halfway through; reverse and saw the other half.

(10) In like manner, saw off the slats from the other edge and from both edges of the other board. Lay aside the slats sawn off, and plane again the edges of the boards, planing so as just to split the 7/16″ gage lines.

(11) Saw off the next slats in a similar way, plane back to the next line and continue till 28 slats are sawn off. Plane the other (rough) side of each slat, till the gage line is split, making each slat 3/16″ thick. Make all slats of uniform thickness throughout.

(12) To facilitate this planing of thin slats, a device may be used such as is shown in Fig. 3. The distance from the inserted cleat to the end is just less than the length of the slats to be planed.

(13) Chamfer off ⅛″ from both short arrises at one end

of each slat, as in Fig. 1. (Use the chisel as in "Hand Work in Wood," Fig. 74.)

II. Making the bottom.

(1) Lay seven slats close side by side, measure their total width, and add six times 3/16", the space between the slats, or 1⅛". The total is the exact size of the bottom. This precaution is taken because the thickness of the original board may not have been exactly ⅞".

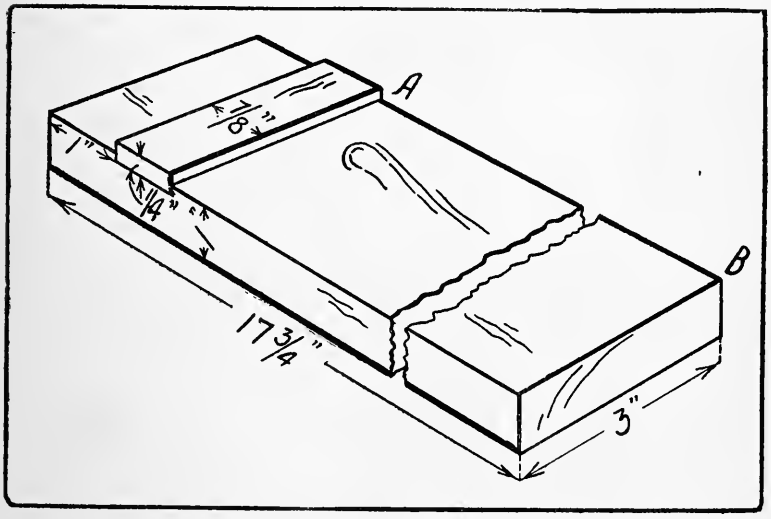

Fig. 3. Device for holding thin strips for planing.

(2) Plane the bottom to this required size and ¾" thick, following the order given on page 72 of "Hand Work in Wood."

III. Making the cross cleats for frame. The piece left from making the slats may be used thus:

(1) Smooth the two broad surfaces, taking as fine shavings as possible. (2) Plane true one edge of the piece (16" long). (3) Gage a line 1¾" from edge. (4) Saw off the surplus and plane to line.

(5) Gage on the planed edges two lines 5/16″ from each broad face. (6) Saw between these two lines and plane back to them. (7) Cut each of these cleats crosswise in the middle. (8) Temporarily, nail all four pieces together, with the sides and one end perfectly flush (Fig. 4), using 1¼″ No. 15 brads.

(9) In the miter box, saw the bunch as long as the bottom is wide. (10) Measure 5/16″ from both ends and lay out as in Fig. 4. (11) Place the bunch in the miter box again and saw on the outside of lines A B. (12) Chisel out the returns (C D, Fig. 4).

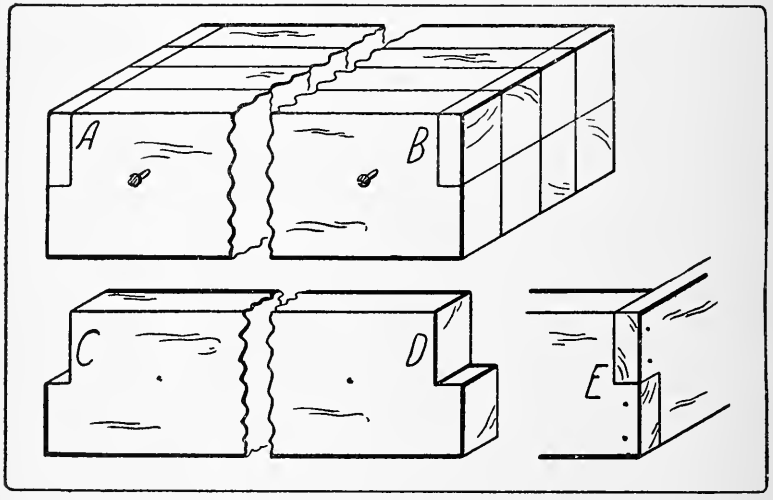

Fig. 4. Method of making and joining frame of scrap basket.

(13) Take the cleats apart and nail them together, reversing two of them, so as to fit into the returns of the other two. Nail both ways (see Fig. 4). (14) Sandpaper all the pieces with sandpaper folded around a block, touching off all the sharp arrises.

IV. Assembling.

(1) On one arris of one of the slats lay out the proper spacing for the slats. These are 3/16″ apart (see Fig. 5). With

a sharp pencil transfer this to each edge of the bottom and to the outside of the frame already made. A mere dot is sufficient.

(2) Nail the slats to the bottom with brads (⅞", No. 18), one brad to each slat, and that one just off the center, to make room for the upholstery nail, which will be driven in later to cover it. The ends of the slats are flush with the lower surface of the bottom.

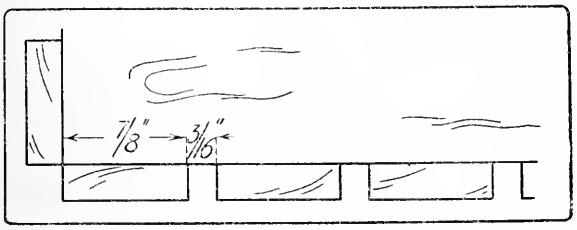

Fig. 5. Arrangement of slats.

(3) Tack the frame temporarily in place, 1¼" from the top of the slats, nailing with brads from the inside of the frame at the corners. (4) Set up the basket, and see that all is square.

(5) To have something solid to nail against, cut a stick of wood just the right length to fit snugly between two opposite members of the frame.

(6) Nail each slat in its place on the frame, using upholstery nails and a mallet, two rows of upholstery nails at the frame and one row along the bottom.

V. The feet. (8 pieces ⅝" x ⅞" x 3½".)

(1) Saw off from the remnant (16" long) two pieces ⅝" thick, ⅞" wide. (2) Saw each of these into two equal rectangular pieces 7" long.

(3) From both ends cut out the returns with the back saw and trim with the chisel. (4) Cut each of these pieces in the middle at an angle of 45°, as in Fig. 6, making 8 pieces. (5) On the outside of each, cut out the decoration with a veining tool or a sharp knife point. (6) Chamfer the long outer arris as in A, Fig. 6. (7) Nail these pieces in mitered pairs at the corners

of the bottom, letting them project outside of the slats just the width of the chamfer.

VI. Finishing.

(1) See that all surfaces are clean of finger and pencil marks. (2) Apply the stain (Bridgeport Wood Finishing Com-

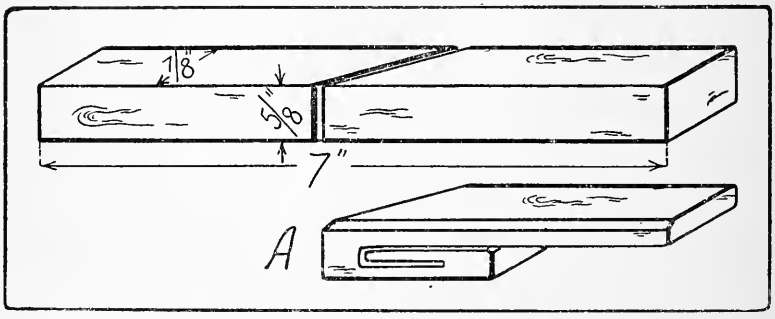

Fig. 6. Feet of scrap basket.

pany's Penetrating Oil Stain is recommended) with a brush (1"), beginning on the inside. (3) Wipe each portion before it dries with cotton waste. See that no parts are left unstained. (4) Rub hard the outer surface with cheese cloth. The more rubbing the better the appearance.

II. PICTURE FRAME CLAMP

The chief new processes involved in this project are boring and perpendicular chiseling. Other projects that involve these fundamental processes are: Pencil holders, a solitaire game, and tool racks.

A pair of these arms with the attached blocks, as shown in Fig. 7, make an excellent clamp for gluing together picture frames. In use, they appear as in Fig. 254, "Hand Work in

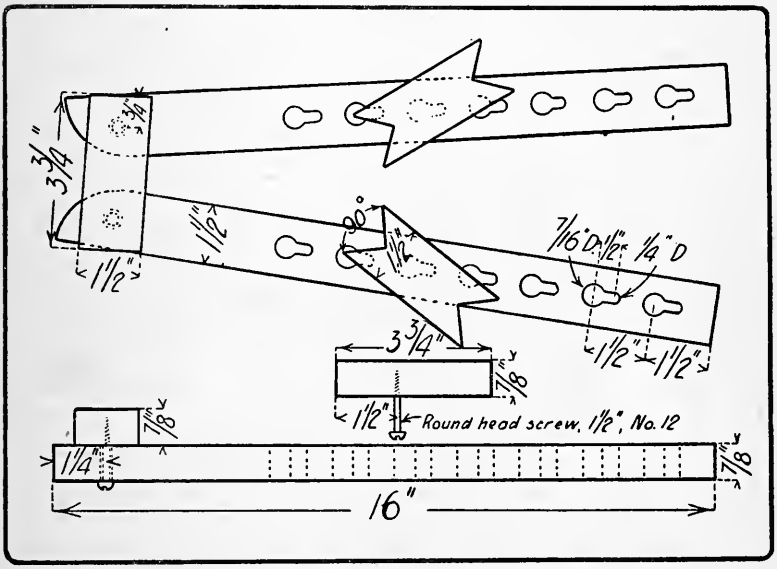

Fig. 7. Picture frame clamp.

Wood." Unless they are to be used often, the arms may be made of yellow poplar, but maple will stand harder and longer usage. In any case, the blocks should be made of maple.

For more explicit directions for this project and for suggestions for other similar projects, see "Studies in Wood," Chapter V.

Materials and Measurements.

4 pieces of yellow poplar: 7/8″ x 1½″ x 15″.
6 pieces of maple: 7/8″ x 1½″ x 3¾″.
8 round head screws: 1½″ No. 12.

Method of Procedure.

I. The arms.

(1) Dress up the four pieces of yellow poplar to size. (2) Lay out a quarter circle at one end of each piece and trim to shape with perpendicular chiseling (see "Hand Work in Wood," p. 56, Fig. 72). (3) Finish with spoke-shave ("Hand Work in Wood," Fig. 120).

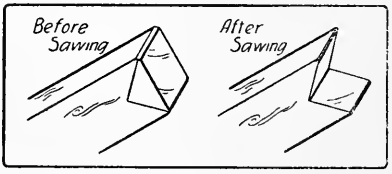

Fig. 8. Method of sawing stop blocks of picture frame vise.

(4) Gage center lines from end to end on both broad sides of each piece. (5) Step off with the compass on these center lines the points for the holes, as shown in drawing (Fig. 7).

(6) Bore the holes. Note that the hole 1¼″ from the quadrantal end is ¼″ in diameter.

(7) With a ½″ chisel cut out the space between each 7/16″ and ¼″ hole. Take care to make these cuts parallel to sides of piece.

II. The blocks.

(1) Dress up six pieces of maple, 7/8″ x 1½″ x 3¾″. (2) Lay out the shape on four of these with an interior 90° angle at both ends. (Fig. 8.) (3) Trim off a little of all the arrises across the thickness. (4) Saw out these angles with back saw, and trim clean with sharp chisel.

(5) Locate a point 1½″ from one end of each piece in center of broad face. (6) Bore at these points holes for screws

with No. 5 gimlet bit. (7) Screw in round-headed screws, 1½" No. 12, till head is ⅞" from surface.

(8) In hinge pieces (the other 3¾" pieces) bore holes partly through with No. 5 gimlet bit. (9) Slip screws (1½" No. 12) through hole in quadrantal end of long pieces and screw to hinge pieces.

(10) Oil all parts with boiled linseed oil and wipe off with cotton waste.

III. PICTURE FRAME

For a discussion of the subject of picture framing, see "Studies in Wood," Chapter VI. Numerous suggestions for variations and embellishments will also be found there.

Another project involving similar processes is a glass bottomed tea tray. (See "Studies in Wood," Chapter VI.)

The directions that follow are for a simple frame for a Japanese print of a crow, as seen in Fig. 9. The size of the print is 9½" x 13½".

Materials and Measurements.

White pine: ⅞" x 1" x 4' 0".
Picture glass: 9½" x 13½".
Picture backing: ⅛" x 9½" x 13½".
2 dozen brads: ⅞" No. 18.
2 screw eyes, (¼" hole), (Brooks, No. 214½).
A little maple veneering 1/28" thick.
Manila paper.
Picture wire.

Method of Procedure.

I. Making the members.

(1) Taking the wood in two pieces, each 24" long, plane to exact width (1") and thickness (¾"), and angles exactly square.

(2) Plow a rabbet ⅜" wide and ½" deep along one arris, as at A, in Fig. 10. (See "Hand Work in Wood," p. 79.)

(3) To prevent the fence of the plane from rubbing on the bench, block up the piece to be planed on another piece, such as shown in Fig. 11.

(4) Cut the miters, making the outside measure of the long members 14⅞" and of the short members, 10⅞". Place the molding in the miter box as in Fig. 12. (5) Test the opposite members to see that they are of exactly the same length.

(6) Test all angles with miter square and try square. (7) If necessary, trim miters with block-plane.

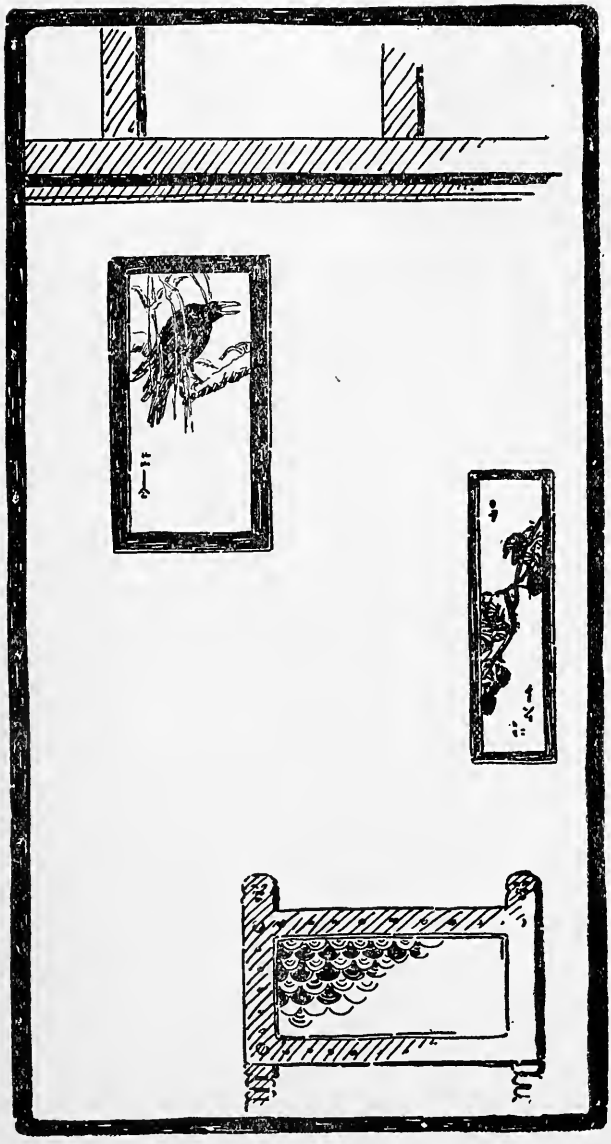

Fig. 9. Framed Japanese prints.

II. Assembling.

(1) Make trial assembly in picture frame clamp (Fig. 7) with hand screw and test with try square.

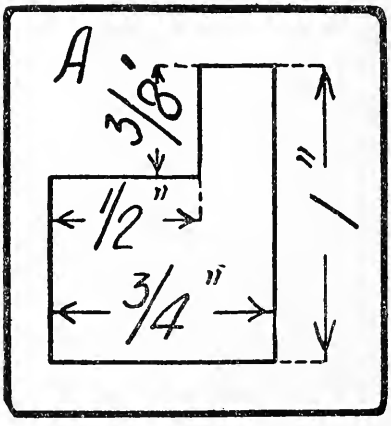

Fig. 10. End view of rabbeted strip.

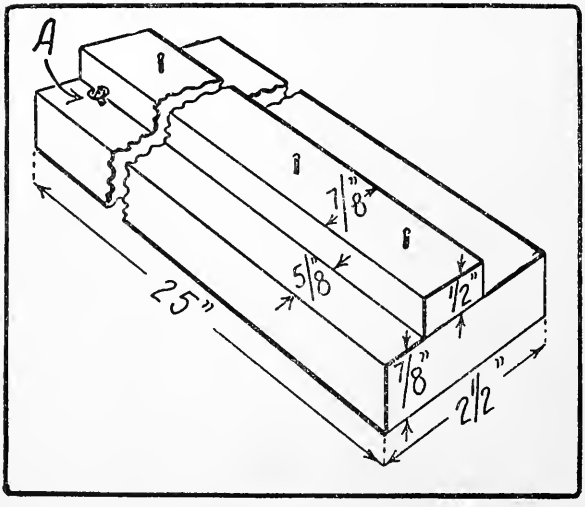

Fig. 11. Device for holding strips when rabbeting.

(2) Apply glue to miters, assemble, clamp up, and test for squareness. (3) When dry (after 6 hours), cut saw kerfs as *a b* in Fig. 13; apply glue to both sides of slip feathers of maple veneering, and insert these in saw kerfs.

(4) Trim off surplus of slip feathers with back saw. (5) Clean off glue with chisel. (6) Dress up the front surface and the edges with plane cutter well sharpened and set fine. (7) Sandpaper in the direction of the grain only.

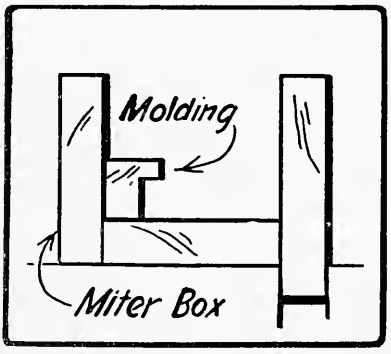

Fig. 12. Position of molding in miter box.

III. Finishing.

(1) Stain to proper color and wax. (See "Hand Work in Wood," p. 214.) (2) Cut picture backing to proper size, 9½" x 13½". (3) Cut glass and polish it with Bon Ami soap. (4) Lay frame face down, insert glass, picture and backing, and nail all in place with brads, ⅞" No. 18, using a light hammer.

(5) Apply a thin film of liquid glue to back of frame; dampen the manila paper on one side and stretch over back of frame. When dry, trim edges.

(6) Insert screw eyes, 2" from the top edge. (7) Stretch picture wire between screw eyes.

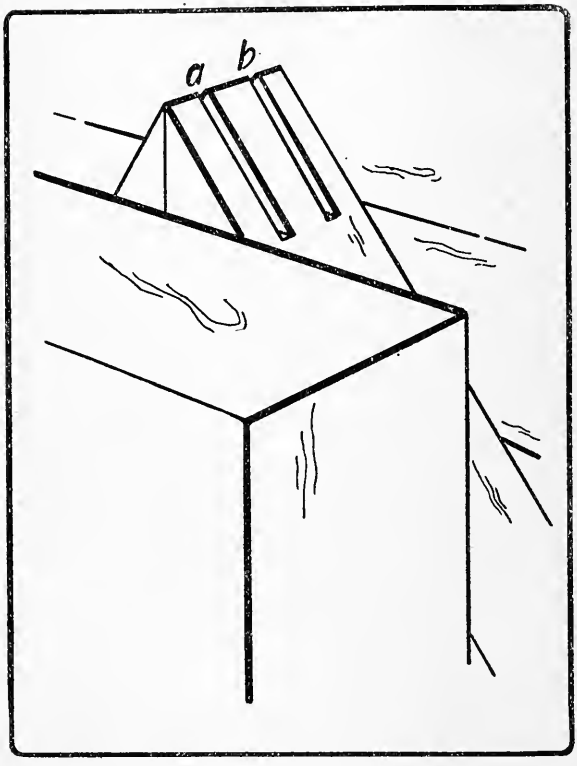

Fig. 13. Kerfs cut in corners of picture frame to receive slip-feathers.

IV. CANDLESTICK

The structural feature of this project is the middle cross-lap joint. Other projects that involve this construction are: flower pot stands, with single or double joint, a ring toss game, and the base of a lamp screen.

The candlestick itself, however, has many artistic possibilities, suggestions for which will be found in "Studies in Wood, Design and Construction," Chapter VII. Suggestions and sketches of other projects may also be found there.

It is suggested that in order to become familiar with the making of the joint, a practice joint be made first of white pine.

The directions which follow are for making the candlestick shown in Fig. 14.

Materials and Measurements.

Mahogany or black walnut:

A. 1 piece, 7/8" x 1¾" x 11".
B. 1 piece, ⅜" x 2⅛" x 8½".
C. 1 piece, 1¾" x 1¾" x 3".

Brads, ¾" No. 18.

Copper, Gage No. 20: 1 piece, 1⅝" x 1⅝"; 1 piece, 1" x 3".

Method of Procedure.

I. The pedestal.

(1) Dress up all surfaces of piece A to ¾" x 1⅝" x 11" ("Hand Work in Wood," p. 72). (2) From each dressed end saw a piece 5" long, using the back saw. (See "Handwork in Wood," page 66.) (3) Dress the sawn ends smooth and true.

(4) Of these pieces make the middle cross-lap joint according to directions given in "Hand Work in Wood," p. 155. (5) Cut with a block plane the chamfers on the ends of all the pieces and with a chisel the stop chamfers on the sides. (6) With a gouge of the correct curve, cut out the coves along the upper arrises.

(7) Glue together the two pieces with hot glue, clamping tight. When dry, clean up and sandpaper.

II. The column. (1⅝″ x 1⅝″ x 3″.)

(1) Dress up the piece C square and true. (2) Mortise one end into the pedestal at the cross ("Hand Work in Wood," p. 160.) (3) Gage the lines *EF* and *GH* (Fig. 15) and connect these points with a fine pencil line to the lower corners as *FI* and *HJ*. (4) Taper the two opposite sides so laid out.

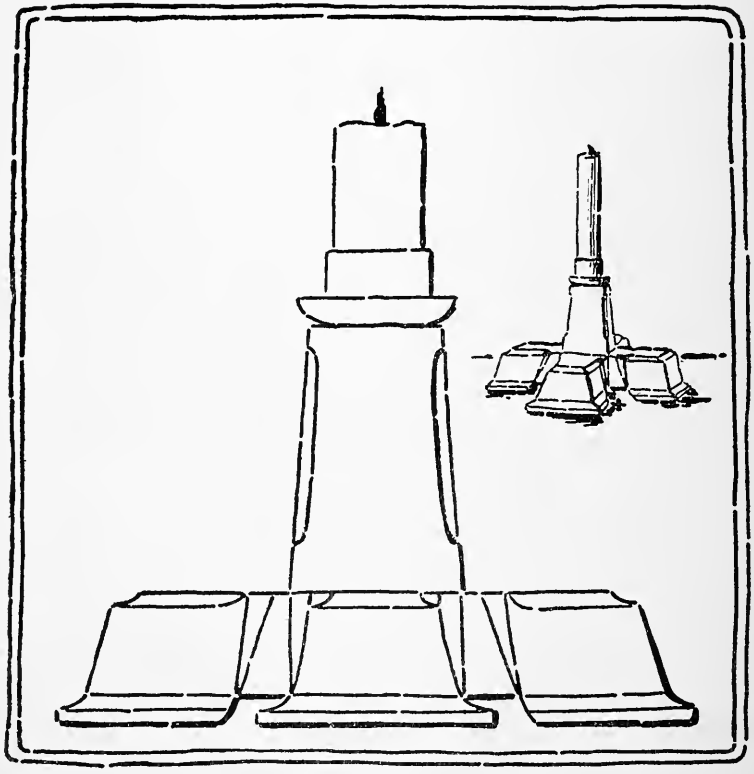

Fig. 14. Candlestick.

(5) Lay out the other two sides in a similar way, as at *LJ* and *MK*, and plane to shape. (6) Cut the coves to correspond with those of the pedestal. (7) Sandpaper. (8) Glue the column into its place, clamping with handscrew.

III. The feet. (4 pieces, ⅜″ x 2″ x 2″.)

(1) Plane up piece B to ⅜″ x 2″ x 8½″. (2) Chamfer or cove the arrises on the edges and ends as in Fig. 14. (3) Cut off from both ends, pieces 2″ long and bevel the inner ends as in Fig. 14. (4) Chamfer or cove the ends again, cut off two more pieces, and bevel. (5) Sandpaper. (6) Fasten these feet in their proper places with brads (¾″ No. 18) and a touch of glue.

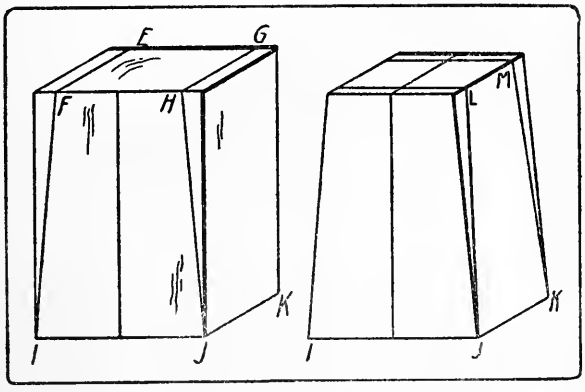

Fig. 15. Lay-out of column for candlestick.

IV. Finish.

(1) For staining mahogany make a saturate solution of bichromate of potash. It dissolves readily in hot water. With one part of this and three of water paint the surface and wipe off at once with cotton waste. (2) When dry, rub with steel wool No. 00.

(3) Oil with a mixture of one part boiled linseed oil and two parts turpentine. Wipe dry and rub often and hard with a rag and a little oil. If more gloss is desired, wax the surface. (See "Hand Work in Wood," p. 214.)

V. The copper socket and plan.[1]

(1) Cut with the snips a piece of copper, No. 20 gage, 1″

[1] For detailed directions for making the copper parts, see "Studies in Wood, Design and Construction," Chapter VII.

wide and a little longer than the circumference of the candle (¾″ diameter). Pound this flat with mallet and file long edges straight and parallel. (2) File end edges with a slight bevel as in Fig. 16. (3) Hammer into a cylinder as shown in Fig. 17.

(4) Wrap with binding wire to hold joint tight; touch joint with soldering fluid. (5) Lay a short piece of wire solder inside on joint, and heat over a gas jet. When solder melts rub it into place with a sharp stick.

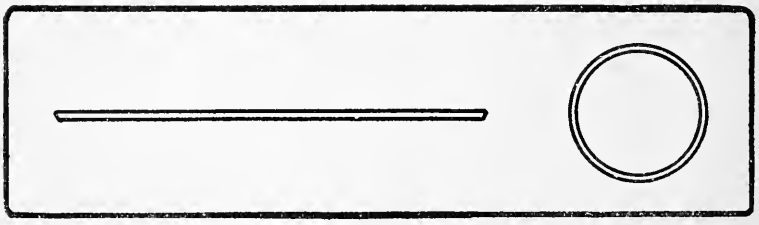

Fig. 16. Ends of strip for socket beveled so as to butt well.

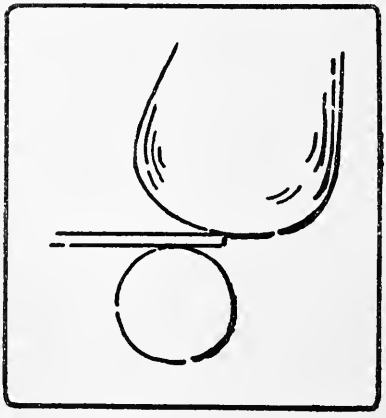

Fig. 17. Method of hammering a cylinder out of a strip.

(6) For making the pan cut out a square of copper 1⅝″ square, snip off the sharp corners, and file edges smooth. (7) Bore two holes in bottom (Fig. 18) and countersink.

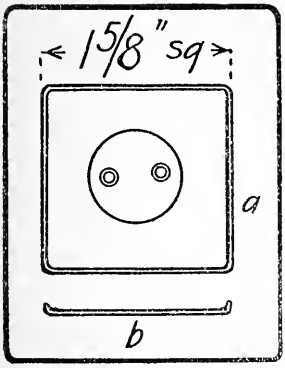

Fig. 18. Plan for candlestick.

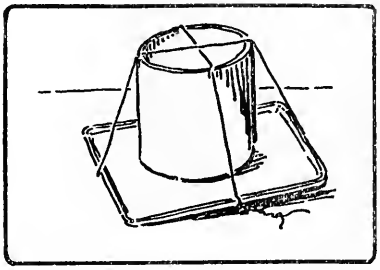

Fig. 19. Socket and pan wired together for soldering.

(8) Wire socket and pan together as in Fig. 19, and solder together. (9) Clean up solder with knife and polish with tripoli. (10) Screw pan to top of column of candlestick.

V. TABORET

Directions follow for making the simple form shown in Fig. 20. Other projects which involve the joints used in this taboret are foot stools and small tables, both of which are subject to great variety of design.

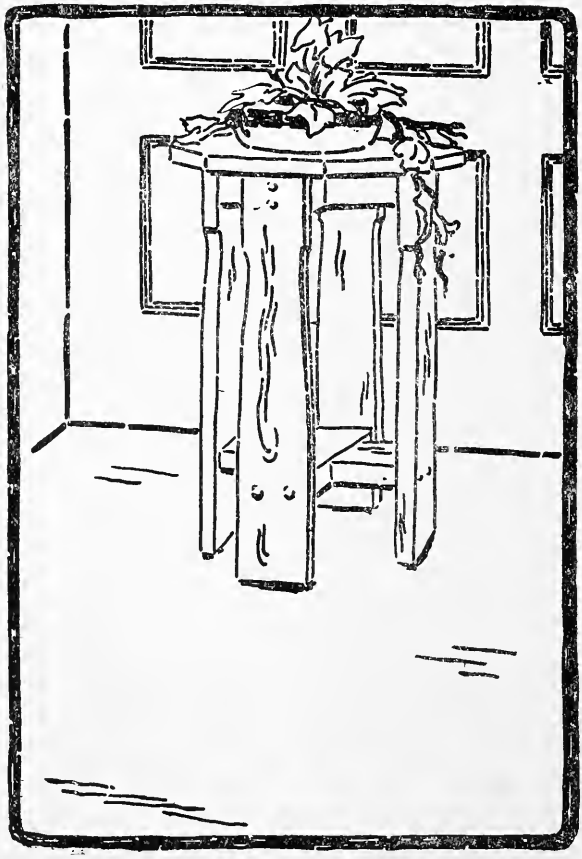

Fig. 20. Taboret.

A variety of modifications of the type shown in Fig. 21, as well as suggestions for new designs for this and similar projects,

are to be found in "Studies in Wood, Design and Construction," Chapter VIII.

Materials and Measurements.

Cypress or chestnut:

A. 4 pieces, ¾″ x 2⅞″ x 17″.
B. 2 pieces, ¾″ x 2″ x 8½″.
C. 2 pieces, ¾″ x 2½″ x 8½″.
D. 1 piece, ¾″ x 13″ x 13″.
16 dowel pins, 5/16″ x 1¾″.
4 brass mending straps, ½″ x 2″, No. 60.
12 screws, ⅝″, No. 4.
16 brads, 2½″, No. 12.

Method of Procedure.

I. Dressing up parts.

(1) Plane up four pieces A to proper size. (2) To trim ends exactly, hand screw all four together and block plane at one time. (3) Plane up stretchers B and C in like manner. (4) Make cross-lap joints with pieces B and C according to directions given in "Hand Work in Wood," p. 155. (5) Glue up these joints and hand screw.

II. Fitting stretchers to legs.

(1) Draw fine pencil line all round each leg 3⅞″ from one end. (See Fig. 22.) (2) On inside of leg mark points 3/16″ from edge. These show location of stretchers. (3) On outside of leg mark points ¾″ from edge. These show location of dowel pins. (4) Mark center lines on edges of stretchers B and C. (Fig. 23.) (5) Draw fine pencil line across center of upper end and down inside and outside of leg as CDE in Fig. 24. (6) Locate points A and B (Fig. 24) for dowels.

III. Shaping the legs.

(1) Clamp two legs together edge to edge, as in Fig. 25, and bore ⅝″ hole at A halfway through. (2) Reverse and bore through. (3) Repeat on all edges. (4) Draw outlines tangent to these holes. (5) Work out surplus wood with draw-shave and spoke-shave.

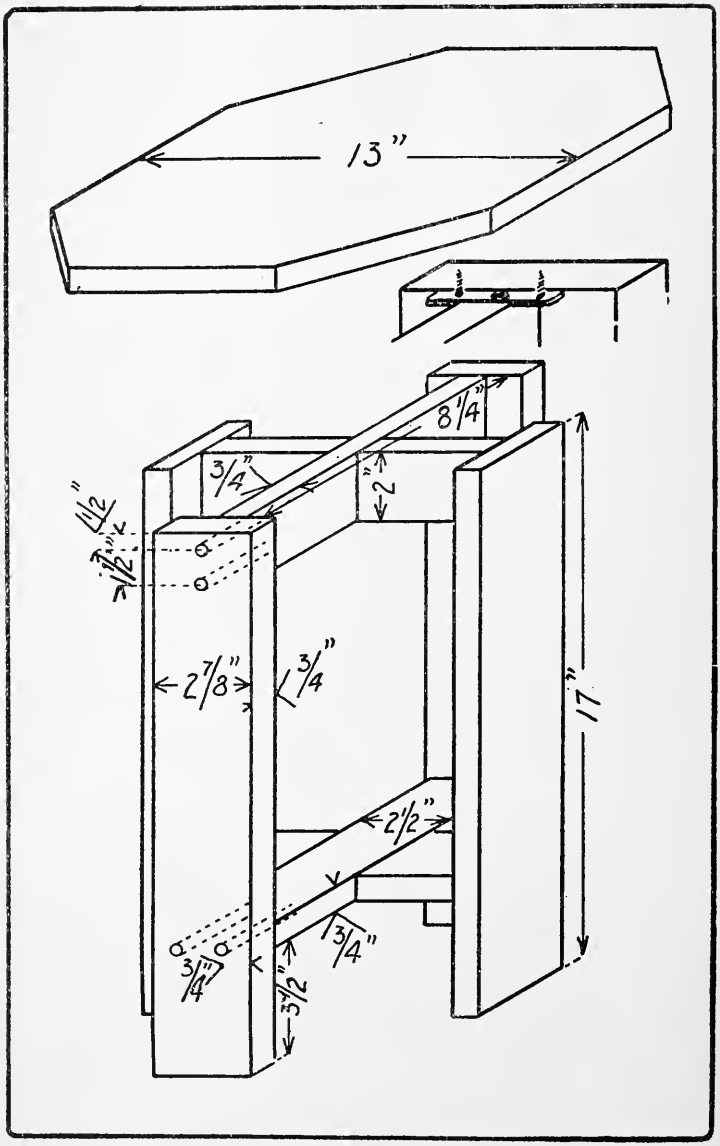

Fig. 21. Working drawing of taboret.

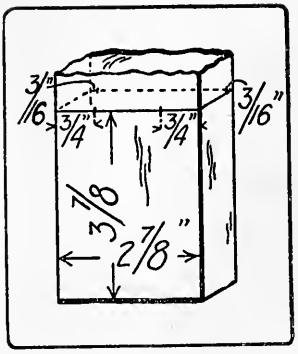

Fig. 22. Lay-out of joint of lower stretcher with leg.

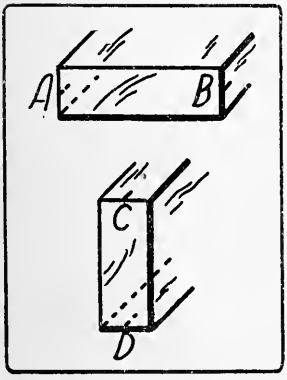

Fig. 23. Centre lines AB and CD marked on stretchers.

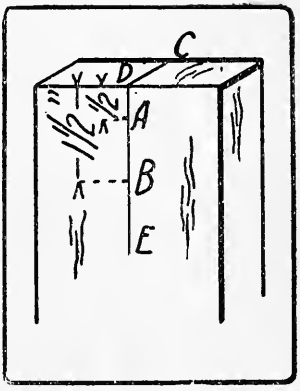

Fig. 24. Lay-out of joint of upper stretcher with leg.

IV. Assembling frame.

(1) Cut 16 dowel pins, 5/16" x 1¾". (2) Partly point one end with dowel pointer and round up other end as in Fig. 26, with knife and sandpaper. (3) At the points in the legs marked for dowel holes bore through the legs with a No. 40 twist drill.

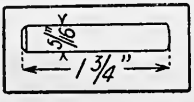

Fig. 26. Dowel pin for taboret.

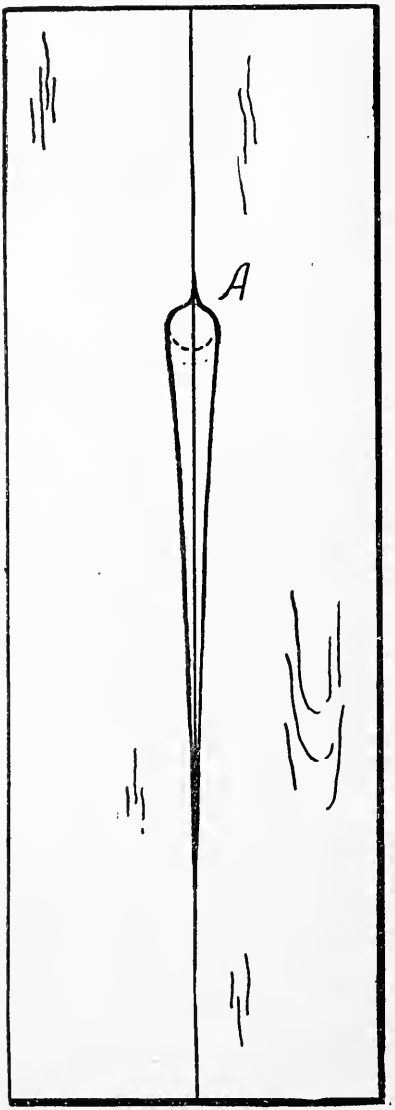

Fig. 25. Method of shaping legs.

(4) Put a little hot glue on each end of stretchers and nail the legs to them with 2½″ No. 12 brads, allowing heads to project.

(5) Clamp all together as in Fig. 248, "Hand Work in Wood," protecting the legs with soft wood blocks. (6) When dry, draw out one brad at a time, bore with 5/16″ bit a hole 2″ deep. (7) Work glue into the hole with a splinter and drive in a dowel pin leaving the rounded end projecting ⅛″. (8) Clean off superfluous glue. (9) Sandpaper, taking pains to touch off all sharp arrises.

V. Making and affixing top.

(1) Plane up the top to size, 13″ x 13″. (2) If the piece has to be jointed, follow the directions for a rubbed joint on pages 172-174, "Hand Work in Wood." (3) Lay out the octagon ("Hand Work in Wood," p. 108), saw off corners and dress to size. (4) Chamfer arrises.

(5) At extreme ends of each upper stretcher cut out a notch to receive brass mending plates (½″ x 2″, No. 60). (6) Bore hole in middle of brass plate to receive ⅝″, No. 4 screw and countersink on opposite side from the other countersinks. (7) Screw these into place as in Fig. 21. (8) On the top laid top side down, locate the frame with the grain of the top parallel to one stretcher, and screw frame into place.

(9) Stain with an appropriate color, oil with boiled linseed oil, and rub. (10) To stain chestnut a brown color, expose it to ammonia fumes in a closed box for 24 hours, and then oil.

VI. MALLET

Some of the processes involved in making the mallet, as curved planing, accurate boring, and modeling, are also to be had in the blotter holder (Section VIII). Dimensions are to be seen in Fig. 28. More explicit directions will be found in "Studies in Wood," Chapter IX.

Materials and Measurements.

Maple: 1 piece, 2½″ x 2½″ x 5″ for head.
Hickory: 1 piece, ⅞″ x 1⅝″ x 11″ for handle.

Method of Procedure.

I. The head.

(1) Plane up working face, working edge, width and thickness. (2) With try square and sharp pencil draw fine center line across all sides. (*ABC*, Fig. 27.) (3) Locate center of two opposite sides on these lines.

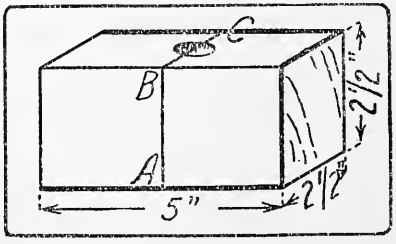

Fig. 27. Maple block for mallet head.

(4) Bore ¾″ hole at these points, boring halfway through from each side. Use ratchet brace and after starting, work with down stroke only. (5) If the holes do not meet exactly, chisel off remaining shoulder with inside bevel gouge (¾″). (6) Slightly elongate hole in direction of grain at one surface. (Fig. 29.) (7) Lay out shape of head on broad side (Fig. 30). (8) Score, with knife point, the lines for bevels at ends, *EC* and *BD* (Fig. 30).

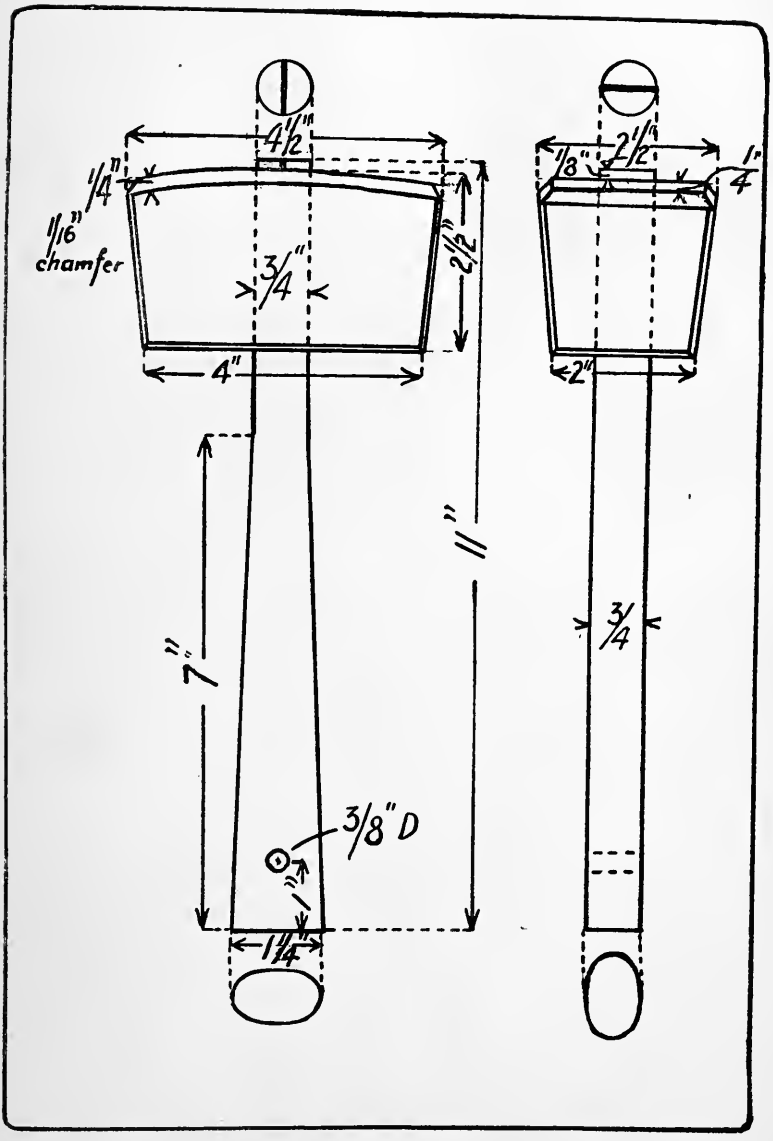

Fig. 28. Working drawing of mallet.

(9) Lay a piece of waste wood on the bench, the mallet head on this on its side and on this, clamp a square, straight piece of wood, exactly along the scored bevel line, *EC,* Fig. 30.

(10) Saw off surplus with cross-cut saw. Repeat at *BD.* (11) Plane ends with jack plane cutter well sharpened and set

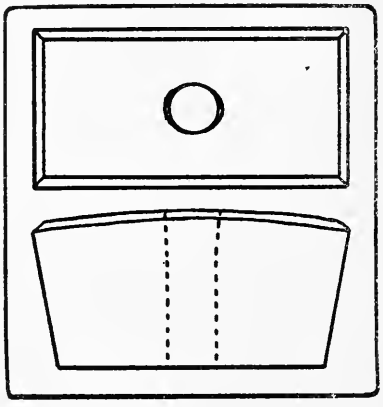

Fig. 29. How the handle hole tapers out.

fine. (12) Draw-shave and then plane off across grain the curved outer surface. (13) Chamfer outer arris to avoid splintering.

II. The handle.

(1) True up the hickory piece to ¾″ (full) x 1½″ x 11″. (2) Lay out plan of handle from center line on both broad sides.

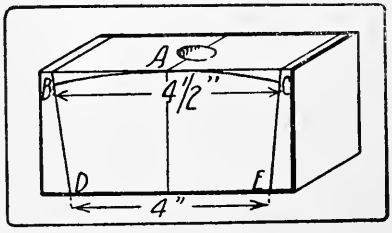

Fig. 30. Lay-out of sides of mallet head.

(3) Bore ⅜″ hole, 1″ from hand end through short axis. (4) Rip-saw off waste on edges, starting from both ends. To start on the tapering cut, clamp on block A (Fig. 32) and start sawing

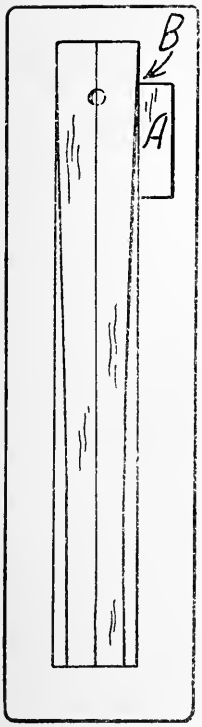

Fig. 32. Method of starting a saw on a tapering cut.

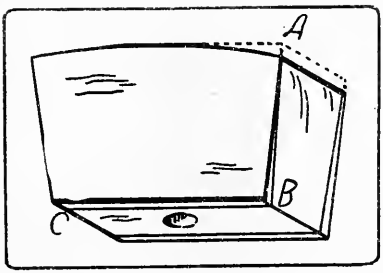

Fig. 31. Lay-out for beveled sides (seen from below).

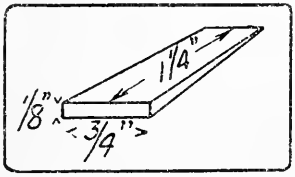

Fig. 33. Wedge for handle.

at B. (5) Save one of the pieces sawn off for wedge to be used later.

(6) Spoke-shave to lines, keeping piece rectangular. (7) Draw center lines on both edges and on ends. (8) Lay out 45° chamfers along all long arrises. (9) Spoke-shave these chamfers. (10) Fit small end of handle in hole in head. (11) Spoke-shave large end to elliptical section. (12) Scrape smooth and sandpaper.

(13) Cut saw kerf 1″ deep at small end parallel with short axis of ellipse at other end. (14) Make wedge as in Fig. 33. (15) Drive handle in head, letting handle project ⅛″. (16) Dip wedge in glue and drive it into saw kerf. (17) Saw off surplus of wedge, and clean up. (18) Give head two coats of shellac, and rub down with steel wool.

VII. PEN TRAY

The process of gouging which is characteristic of the making of a pen tray is, of course, applicable to trays for other purposes as for comb and brush, pins or clips, crumbs, trinkets, etc.

Directions follow for making the pen tray shown in Fig. 270, "Hand Work in Wood." Plan and cross section of this are shown in Fig. 35. (See also Fig. 34.) Numerous other designs and suggestions for designing, as well as more explicit directions for making various kinds of trays, are to be found in "Studies in Wood," Chapter X.

Materials and Measurements.

Sweet gum: ½″ x 2⅝″ x 9.″

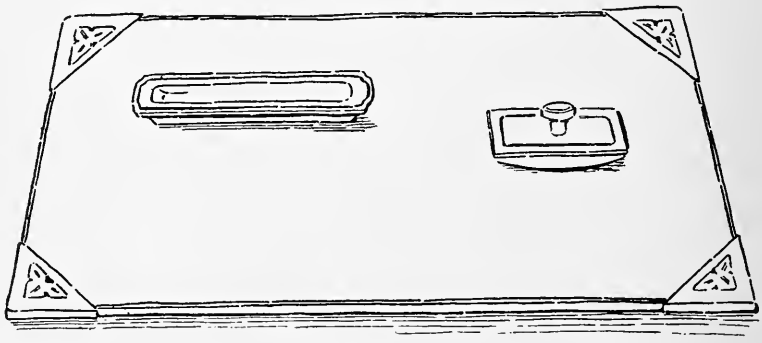

Fig. 34. Pen tray and rolling blotter holder.

Method of Procedure.

(1) Dress up four surfaces to size. (2) Draw center lines lengthwise and crosswise on face. (3) Draw the design on stiff paper, lay it on glass and with a sharp knife-point cut a stencil of one-quarter of it. With this stencil lay out design on working face of board.

(4) Make a depth-gage by driving a 1″ nail into a straight strip of wood, letting the nail project the amount of the depth of the trough, ⅜″. (5) Gouge out trough of tray with 1″ outside bevel gouge. (See "Hand Work in Wood," p. 60 and Fig. 82.)

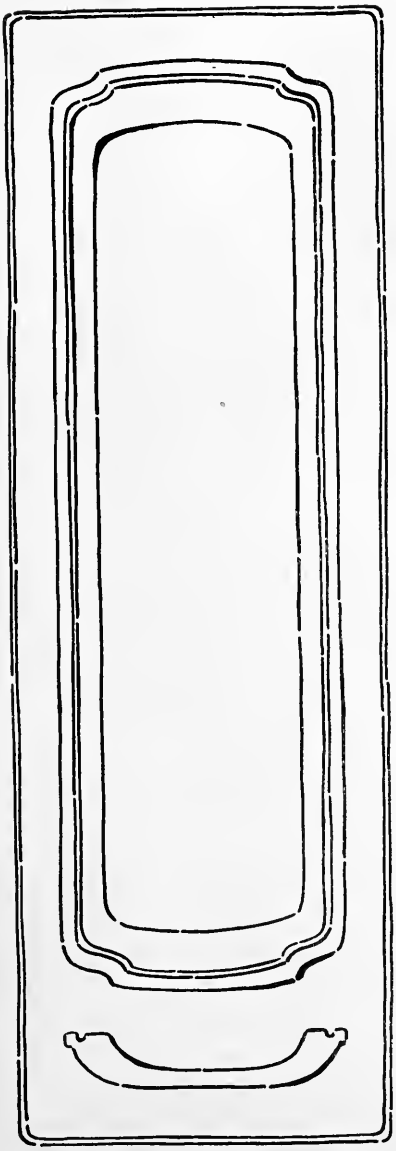

Fig. 35. Pen Tray.

Finish gouging with twisting motion of gouge, and test depth frequently with depth-gage. Take particular pains at ends. (6) Scrape surface of trough with cabinet scraper. For method of sharpening, see p. 92 "Hand Work in Wood." (7) Sandpaper the trough smooth.

(8) Carve the decorations. For simple line work, as in this design, a small gouge or "veining tool" is sufficient. Cut clean with a sharp tool and do not attempt to sandpaper the lines.

(9) Shape the ends, first with the chisel ("Hand Work in Wood," pp. 56 and 57), chiseling as smooth as possible, and then use sandpaper on a block. (10) Turning the piece on its face, gouge a cove along the arris of the under side. This may be made into an ogee with the chisel. (11) Scrape smooth, and sandpaper.

(12) Rub all over with steel wool (No. 00) to make as smooth as possible. (13) Oil with boiled linseed oil. (14) Apply several coats of white shellac, rubbing each down with steel wool. (15) French polish according to directions in "Hand Work in Wood," p. 127.

VIII. ROLLING BLOTTER HOLDER

Directions follow for the design shown in Fig. 34. For other designs and more explicit directions see "Studies in Wood," Chap. XI.

Materials and Measurements.

Sweet gum:

A. 1 piece, ¾″ x 3″ x 5″ (full).
B. 1 piece, ¼″ x 3″ x 5″ (full).
C. 1 piece, 1″ x 1″ x 2″ (full).
1 dowel, ⅜″.

Method of Procedure.

(1) The construction is shown in Fig. 36. (2) True up to size the two larger pieces, A and B. (3) Locate the center of face of each piece. (4) Bore ⅜″ hole through B and 5/16″ hole through A and a 5/16″ hole nearly through C.

(5) With tap belonging to screw-box cut threads in holes in A and C. (6) With screw-box cut threads on dowel for two inches. (7) Put a little glue in hole of piece C and screw in dowel.

(8) Piece C is taken two inches long to prevent splitting while boring. Cut off the surplus half inch at each end of piece. (9) Lay out form on two opposite sides, chisel and gouge sides into shape. (10) Lay out form on these two sides and work the other two into shape, and finally, using also file and sandpaper, work into circular shape and finish.[1]

(11) Gouge the decoration on knob C and on cover B. (12) Lay out curve on edge of A. (13) Saw off surplus with ripsaw and smooth with the plane across the grain, holding the piece in the bench vise, and tilting it with one end projecting above the bench. (13) Finish the edges as at *AA*, Fig. 36.

(14) Sandpaper all parts thoroughly. (15) Finish with oil and shellac as in the case of the pen tray. (16) Fasten a pad of felt on rounded surface of block A by means of thick shellac. (17) Insert blotting paper of proper size.

[1] This knob would better be turned on a lathe if one is available.

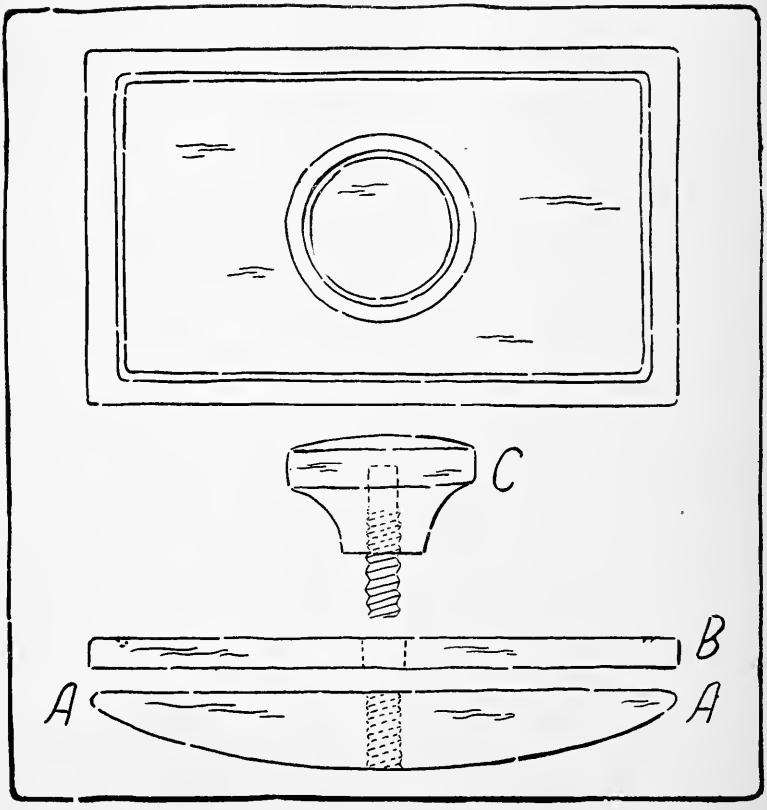

Fig. 36 Rolling blotter holder.

IX. TRINKET BOX

The variety of uses to which boxes can be put, as, for example, gloves, cigars, neckties, stationery, toilet articles, cutlery, not to speak of bird houses and plant boxes, gives this project a constant interest. Other designs and suggestions will be found in "Studies in Wood," Chapter XII. For the variety of joints possible, see "Hand Work in Wood," pp. 187-190.

The directions which follow are for a box 3″ deep, 4″ wide and 7″ long, outside dimensions. (Fig. 37.)

Materials and Measurements.

Black walnut or mahogany:
1 piece, ⅜″ x 8″ x 20″.
2 brass butt hinges: 1″, narrow.
8 flathead brass screws: ⅜″, No. 2.
Brads: 1″, No. 18.

Method of Procedure.

(1) Cut from the board 2 pieces 3″ wide and 12″ long, each sufficient for one side and one end. (2) Dress up working face, working edge, one end, the width (2⅞″) and thickness (5/16″).

(3) From dressed ends measure 3¾″. Score all around with knife point and cut out saw groove. (See "Hand Work in Wood," Fig. 91.) Do *not* saw off yet.

(4) Plow rabbets 3/16″ deep from face of board and 5/16″ wide from edge along one edge of each 12″ board. (See "Hand Work in Wood," p. 79.) (5) On other edge of both boards plow out rabbet 3/16″ deep and 3/16″ wide. (See Fig. 38.)

(6) Saw off pieces 3¾″ (to be ends of box) and block plane true. Both pieces must be exactly the same size, 5/16″ x 2⅞″ x 3¾″, and all angles square.

(7) On both ends of each side piece cut rabbets ("Hand Work in Wood," p. 179, No. 24) with the shoulders 6⅜″ apart, rabbet 3/16″ deep, letting surplus project as in Fig. 39. Use knife, back-saw and chisel.

(8) Apply a little glue on joints (liquid glue will do), clamp up as in Fig. 40, and nail sides and ends together, locating

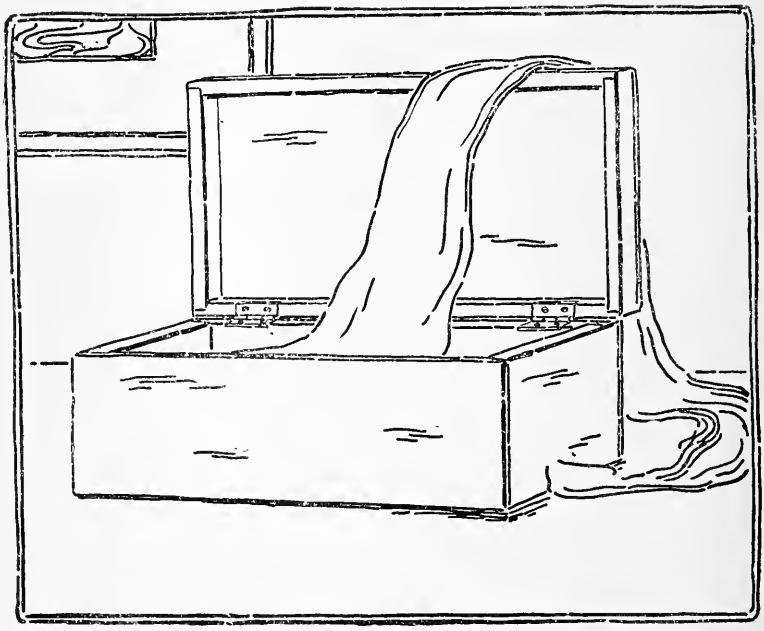

Fig. 37. Trinket box.

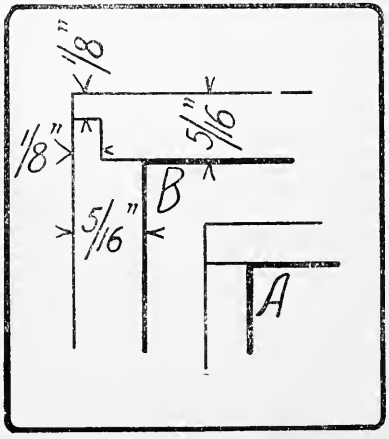

Fig. 38. Methods of affixing the top of the box

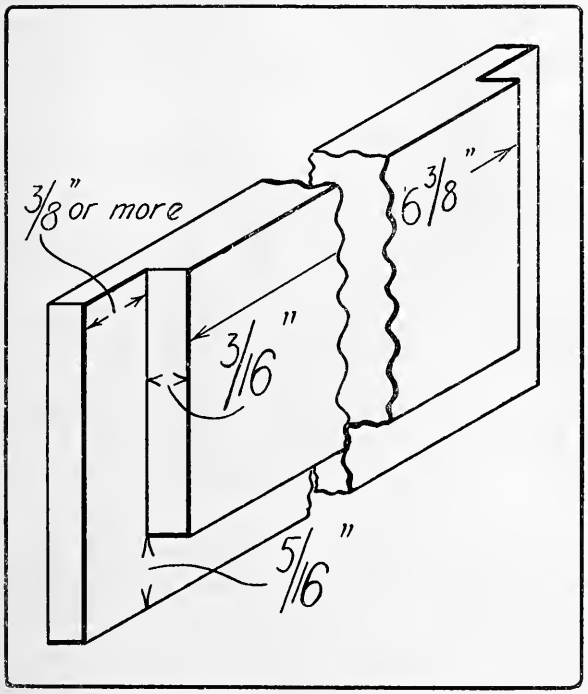

Fig. 39. Rabbeted side of box.

brads as in Fig. 41, and driving as in Fig. 40. (9) Nail-set brads, and stop up nail holes with plugs of same kind of wood trimmed to fit and glued in. Set away to dry.

(10) When dry, clean up any superfluous glue and dress upper edges perfectly plain.

(11) Plane bottom to exact size. Glue and brad it into place.

(12) Plane top piece to thickness 5/16". Make edges true and square, but the size slightly larger than necessary.

(13) Plow rabbets on all its edges, 3/16" deep, and wide enough so that top will fit into place. (14) Glue on top, clamping with hand screws and with protecting boards between. (15) When dry (6 hours) dress off projecting parts.

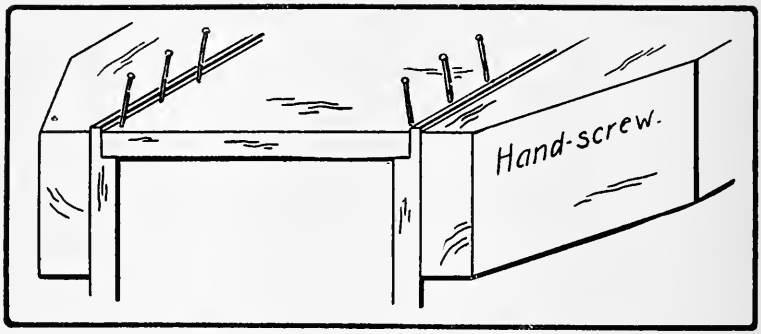

Fig. 40. Method of driving brads in box.

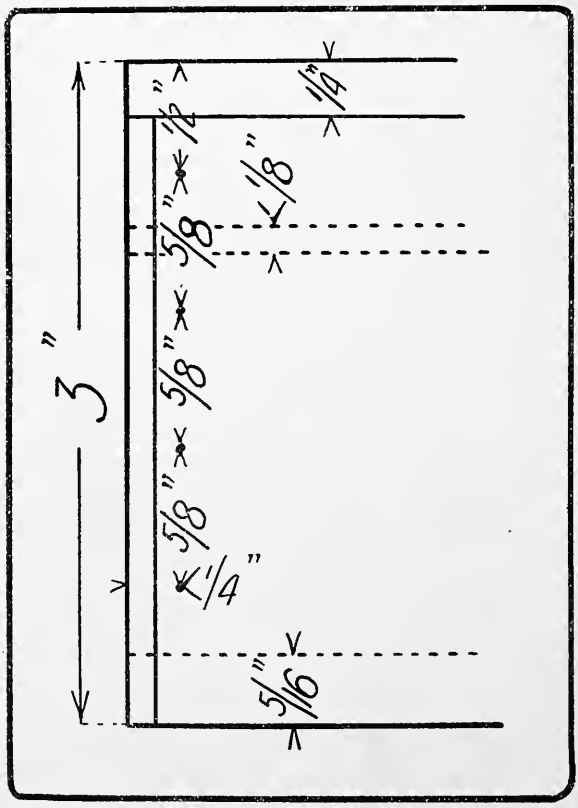

Fig. 41. Location of brads in end of box.

(16) Gage two parallel lines, ¾″ and ⅞″ from top, on sides and ends. (17) Saw box apart between these two lines. (18) Dress these edges to perfect planes, so that they fit exactly. (19) Set the hinges. (For directions, see "Hand Work in Wood," p. 132.)

(20) Clean up thoroughly, sanding off the outer arrises except those where the lid and box meet. (21) Stain with bichromate of potash if wood is mahogany. (See above, p. 21) (22) Rub down with steel wool. (23) Coat with Wheeler's Paste Wood Filler (see "Hand Work in Wood," p. 213), No. 7, for mahogany, or No. 10 for black walnut.

(24) When dry, touch up carefully with steel wool, shellac and finish like tray. (See p. 36.) (25) Instead of shellac, the box may be well oiled and rubbed often.

X. HANGING LANTERN

A variety of designs both for hanging lanterns and wall lanterns and lamp screens will be found in "Studies in Wood," Chapter XIII. Only one form of hanging lantern is described here. (See Fig. 43.)

Materials and Measurements.

Yellow poplar, 5/16" thick:

For the corners or stiles: 4 pieces, 5/16" x 1" x 8"; 4 pieces, 5/16" x 11/16" x 8".

For the cross pieces or rails: 4 pieces, 5/16" x 1½" x 4½"; 4 pieces, 5/16" x 1¾" x 4½".

For the horizontal cross slats: 4 pieces, 5/16" x ⅝" x 4½".

For the muntins (vertical slats): 8 pieces, 5/16" x ⅝" x 5¼"; 2 cleats, 5/16" x 5/16" x 3"; 1 stretcher, 5/16" x 3" x 5¾".

Manila or brown paper for lining.

4 screw eyes, No. 214½.

Copper or brass chains for suspension.

Corrugated fasteners, 3/16".

Method of Procedure.

(1) Dress all these pieces to size. Work with as long pieces as is convenient to plane and then cut to proper lengths.

(2) Where there are a number to cut to one length, make a jig by fastening a stop in miter box at proper distance and saw off pieces by that means. If accurately sawn no truing is necessary.

(3) Dress ends of stiles smooth.

(4) Shape rails, upper and lower, with chisel and spoke shave.

(5) Fit cross-lap joints of slats. For directions for making this joint see "Hand Work in Wood," p. 155. (6) Glue together.

(7) Make up corners by gluing stiles together, as Fig. 42. (8) When dry dress off outer surfaces.

Fig. 42. Corner posts of lantern.

(9) Nail two slats about 9″ long on a flat board 7½″ apart, as *AA* in Fig. 44.

(10) Prepare two wedges *BB* 8″ long, 5/16″ thick, and tapering from ⅝″ wide to a point, and a buffer strip *C*.

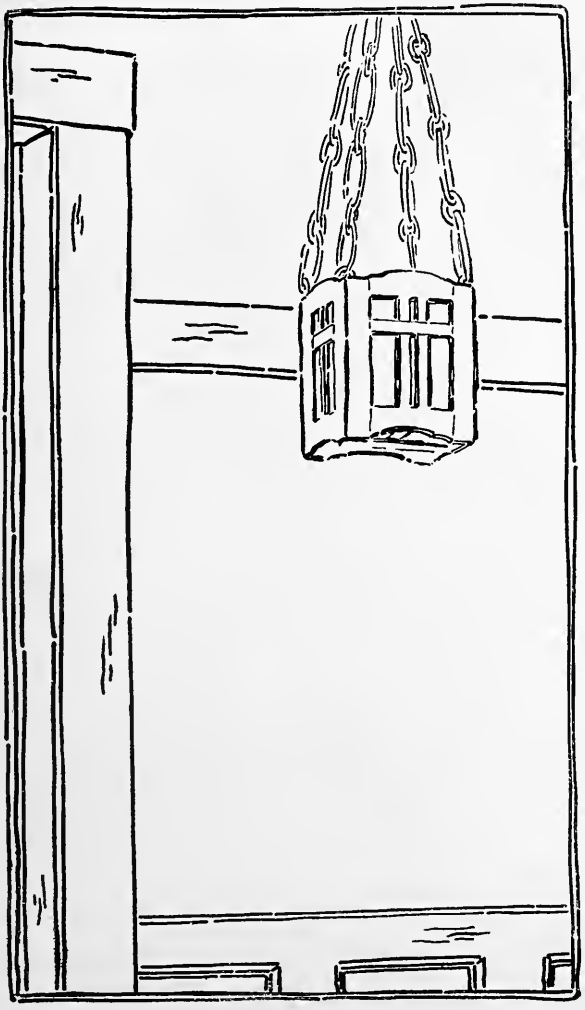

Fig. 43. Hanging lantern.

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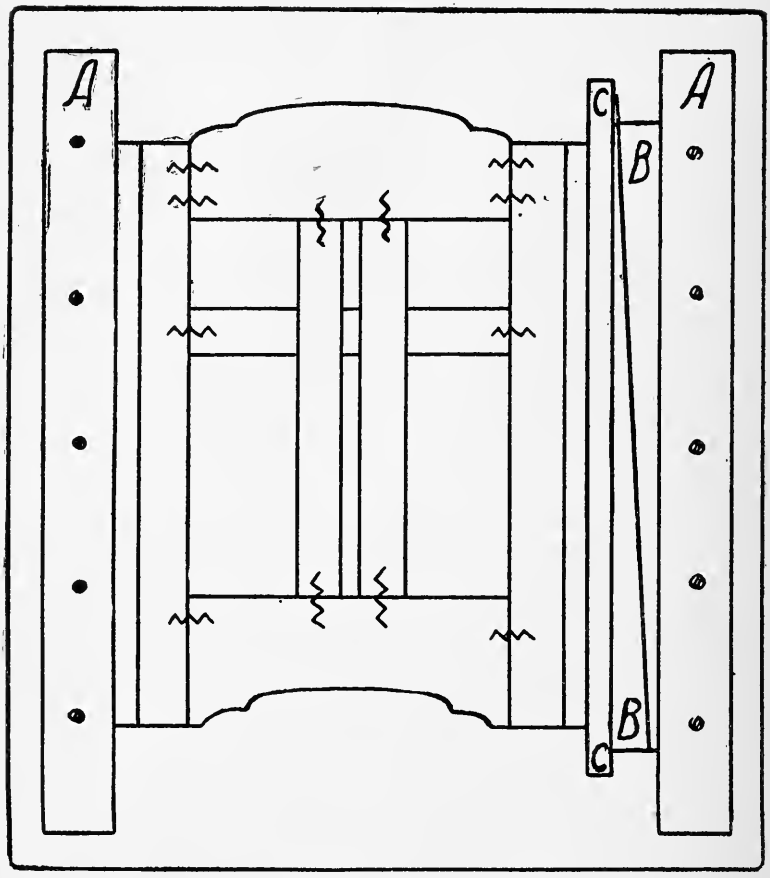

Fig. 44. Method of clamping up the parts.

(11) Lay the pieces on one side, outside down, in their proper position in this space. (12) Put in strip *C* and drive in wedges *BB*. (13) See that all is square and flat as in Fig. 44.

(14) At all joints drive 3/16″ corrugated fasteners.

(15) Repeat on all sides.

(16) Stain with brown oil-stain, and rub well.

(17) Cut brown or manila paper and glue on inside with liquid glue. (18) Fasten in place with glue and brads two nar-

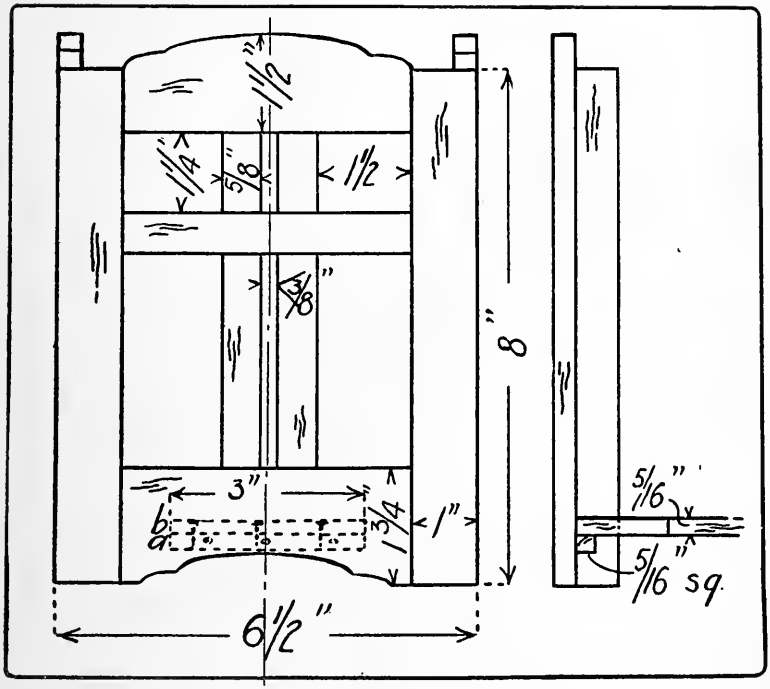

Fig. 45. Drawing of lantern shown in Fig. 43.

row cleats 5/16" x 5/16" x 3", as *a* in Fig. 45. (19) To these cleats nail stretcher *b*, 3/16" x 3" x 5¾". (20) To middle of this stretcher screw a copper candle holder (socket and pan) made as for project IV. (21) If electric light is to be used, fasten this stretcher to the *upper* rail and attach socket for bulb.

(22) Screw four small screw eyes (No. 214½) into each of the upper inside covers and attach four copper or brass chains or wires for suspension.

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